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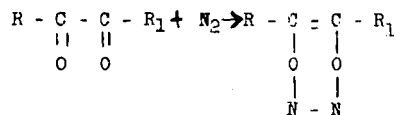
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TWO-COMPONENT STRUCTURE OF CATALYST FOR NITROGEN FIXATION IN AZOTOBACTER;
PHYSIOLOGICAL COURSE OF MOLECULAR NITROGEN FIXATION

M. V. Fedorov
Lab of Plant Physiol and Microbiol
Moscow Agr Acad imeni K. A. Timiryasev
Submitted by Acad N. A. Makimov, 27 May 49

[A Digest]

Experimental data in the author's previous work made it possible to determine that the protoplasm in cells of Azotobacter contains a specific catalyst (ferment) which takes care of the fixation of molecular nitrogen. This catalyst's molecule was found to contain an amino, a carboxyl, and carbonyl group. Only one of these three groups, the carboxyl, takes part directly in the fixation of atmospheric nitrogen. On the basis of this data, the author developed a preliminary scheme explaining the process of fixation in which it was assumed that the molecular nitrogen reacts with the hydrated carbonyl groups. However, investigation of ascorbic acid's influence on fixation of nitrogen on frozen cells of the Azotobacter, showed that two adjacent carbonyl groups participated in the fixation process as follows:



Considering the previously determined presence of protein in the catalyst for nitrogen fixation and taking into account the depressing influence of surface-active compounds on the fixation, it must be recognized that the catalyst has a two-component structure. The molecule of protein performs in it the function of a colloid carrier, and a low-molecular substance the

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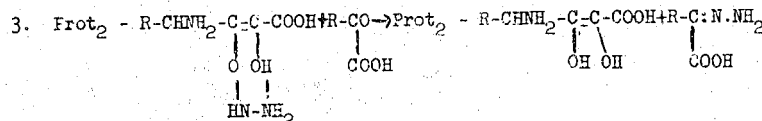
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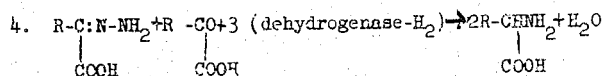
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The reduced forms of nitrogen thus obtained, apparently, interact with ketonic acids and are transformed into hydrazine derivatives of the corresponding ketonic acids:



Hydrazine derivatives of ketonic acids are reduced to amino acids and used for the building up of the protein of the Azotobacter's protoplasm:



All factors connected with the fixation of atmospheric nitrogen by bacteria are explained by the above method. The positive effect of oxygen, hydrogen peroxide, and other oxidizing agents is due to the formation of free carbonyl groups in the catalyst for nitrogen fixation, while the depressive effect of molecular hydrogen, hydroquinone, hydrogen sulfide, and other reducing substances is due to the reduction of carbonyl groups.

The depressive effect of aldehydes reacting with the amino group is connected with the introduction into the molecule of active groups of reduced compounds. The latter interfere with the oxidation of nitrogen and change the chemical properties of the catalyst. The activating effect of boric and molybdic acids is based on the introduction of oxidizing compounds favoring the oxidation of nitrogen into the molecule of the active group of the catalyst. The depressing effect of surface-active substances can be explained by the blocking of border surfaces between the active group and the colloid carrier, and the depressive action of heavy metals by the change of the state of the active group as well as of the colloid carrier.

All facts are thus clarified and the possibility of partially removing fixation products by means of solution is a direct confirmation of the possible formation of hydrazines as original products of atmospheric nitrogen binding.

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